

maintaining three drawings, general resemblances and special differences appear on comparison with the sketches of Prof. Phillips and Mr. Lockyer. The differences affect principally the grey southern parts, and are remarkable enough to justify serious doubts whether any of our drawings of those parts are much to be trusted as representing permanent physical boundaries. Nor should this be thought surprising; owing to the high inclination of the axis of Mars to the plane of his orbit, the regions round each pole are presented alternately to the sun through periods somewhat less than our whole year. The effect is seen in the vast outspread of snows round the cold pole, and the contraction of those white sheets to a small glittering ellipse round the warm pole. The enormous transfer of moisture from one hemisphere to the other while the snows are melting round one pole and growing round the other must generate over a great part of the planet heavy storms and great breadths of fluctuating clouds, which would not, as on the quickly rotating mass of Jupiter, gather into equatorial bands, but be more under the influence of prominent land and irregular tracts of ocean.

February 19, 1863.

Dr. WILLIAM ALLEN MILLER, Treasurer and Vice-President, in the Chair.

Pursuant to notice given at the last Meeting of the Society, The Right Honourable Edward Pleydell Bouverie, and His Grace the Archbishop of York, were proposed for election and immediate Ballot.

The Ballot having been taken, Mr. Bouverie and the Archbishop of York were declared duly elected Fellows of the Society.

The following communication was read :—

“On Thallium.” By WILLIAM CROOKES, Esq. Communicated by Professor STOKES, Sec. R.S. Received February 5, 1863.

(Abstract.)

After discussing the occurrence and distribution of the new metal in different parts of the globe, the author proceeds to describe the method adopted by him for extracting it from its ore. Thalliferous pyrites is distilled at a bright red heat, in quantities of about 1 cwt. at a time, in cast-iron retorts. The resulting sulphur, varying from 13 to 17 per cent. of the pyrites taken, is then dissolved in aqueous caustic soda, which leaves the sulphide of thallium as an insoluble black precipitate; this is filtered off, dissolved in acids, and the thallium precipitated in the form of iodide. This is then converted into sulphate, and the metal reduced from the solution by electrolysis. It is obtained in the coherent form by fusion under cyanide of potassium.

The physical characteristics of thallium are then described. In appearance it most resembles tin and cadmium, but has a distinct colour of its own; it has a brilliant metallic lustre, and is susceptible of taking a very high polish; it oxidizes in the air with almost the rapidity of an alkaline metal, but when coated with oxide, the metal may be freely handled and exposed to the air with scarcely any further change. An oxidized surface applied to the tongue is very biting and caustic, and has a sweetish metallic taste. It is the softest known metal admitting of free exposure to the atmosphere, being scratched by soft lead with the greatest ease. It makes a dark blue mark upon paper, rapidly turning yellow, which in the course of a few hours nearly fades out, but can be restored with sulphide of ammonium. It has little tenacity, is very malleable, and may be readily pressed into wire.

The specific gravity of thallium varies from 11·81 to 11·91, and it is probably capable of still greater condensation.

When freshly prepared, thallium wire is perfectly amorphous, but when kept in water it gradually assumes a superficial crystalline appearance: this effect is immediately produced when thallium in wire, ingot, or plate, tarnished or clean, is boiled in water.

Its melting-point is 550° F., being between bismuth and lead,

and the metal does not become pasty before undergoing complete fusion. Two pieces of clean metal weld together by pressure in the cold. It begins to volatilize at a red heat, and boils below a white heat; it may be distilled in a current of hydrogen.

It is a pretty good conductor of heat and electricity, and stands electro-chemically very near cadmium. It is strongly diamagnetic, ranking in this respect near bismuth. The alloys which thallium forms with different metals are next described.

Further details are given respecting the spectrum of thallium: the characteristic green line is perfectly single under a very high magnifying power and after refraction through nine heavy glass prisms; and no new lines make their appearance at the temperature of the oxyhydrogen blowpipe,—although, with the electric spark, Dr. Miller has shown that several new lines come into existence.

The delicacy of the optical test for thallium is roughly estimated, the $\frac{1}{5,000,000}$ th of a grain being easily perceptible.

The atomic weight of thallium is given as 203, being the mean of five experiments. The author states, however, that this is not to be regarded as a final result.

The chemical properties of thallium are next described. It does not decompose water even at the boiling-point, but remains bright under this liquid. The superficial tarnish is a powerful base soluble in water, and reacting like an alkaline solution. Melted in the air, thallium forms a readily fusible oxide, its behaviour resembling that of lead.

The formation of thallic acid and the properties of some of the thallates are described. Sulphate, nitrate, the chlorides, sulphide, iodide, and other salts of thallium are described in detail. The metal may be quantitatively determined by precipitation, either as protochloride, iodide, or platinochloride.

The position of thallium amongst elementary bodies is then discussed. Although one or two of its properties show a resemblance to the alkaline metals, the author does not agree with continental chemists in classing it with this group,—numerous facts proving that its true position is by the side of mercury, lead, or silver. The ready dehydration of its basic oxide; the insolubility of its sulphide, iodide, chloride, bromide, chromate, phosphate, sulphocyanide, and ferrocyanide; its great atomic weight; its ready reduction by zinc

to the metallic state ; its power of forming a strongly acid oxide ; and, according to Dr. Miller, the complexity of its photographic spectrum,—all prove that thallium cannot consistently be classed anywhere but amongst the heavy metals, mercury, silver, lead, &c. No weight is attached to M. Dumas's argument in favour of thallium being related to potassium and sodium because its equivalent is rather near a figure obtained by adding twice the atomic weight of one metal to four times the atomic weight of the other. The author shows that, by similar processes of addition, multiplication, or subtraction, it is not difficult to prove that thallium is related to any desired group of elements.

The author gives full analytical notes on thallium, showing where it would occur in the ordinary course of analysis, and detailing accurate methods of separating it from every metal with which it can be accompanied.

February 26, 1863.

Major-General SABINE, President, in the Chair.

The following communications were read :—

- I. "On the Effect of Temperature on the Secretion of Urea, as observed on a Voyage to China, and at Hong Kong." By EMIL BECHER, M.D., Assistant-Surgeon, Army Medical Staff. Communicated by Dr. EDMUND A. PARKES. Received January 20, 1863.

(Abstract.)

With a view to extend our knowledge of the physiological effects of temperature, with especial regard to the influence of tropical heat on the healthy system, Dr. Becher, with the liberal assistance of the Director-General, Army Medical Department, took advantage of a voyage to China (round the Cape of Good Hope) in 1857, and a short residence at Hong Kong, in order to *determine on himself the influence of the extreme variations of temperature* incidental to that voyage, on the quantity of urine, urea, and chloride of sodium excreted during each twenty-four hours.